Available online at www.sciencedirect.com

ScienceDirect

Procedia Technology 24 (2016) 562 – 567

Procedia Technology

International Conference on Emerging Trends in Engineering, Science and Technology (ICETEST - 2015)

Stock control in a chemical firm: combined FSN and XYZ analysis

Divya Devarajan[a*], M S Jayamohan[b]

[a]*M.Tech scholar: Dept. of Mechanical Engineering, Rajiv Gandhi Institute of Technology (RIT),Kottayam-686501, India*
[b]*.Professor: Dept. of Mechanical Engineering, Rajiv Gandhi Institute of Technology (RIT), Kottayam-686501, India*

Abstract

Inventories occupy the most strategic position in the structure of working capital of most business enterprises. It constitutes the largest component of current asset in most business enterprises. In the sphere of working capital, the efficient control of inventory has passed the most serious problem. The efficiency of inventory control affects the flexibility of the firm. Proper inventory control helps to make effective use of working capital by maintaining the right amount of stocks of materials, components etc thereby over stocking is avoided. Thus, the working capital will not be blocked in excess inventory.

The Company's success lies on its timely completion, within specific budget and with required performance. In particular an efficient and effective inventory management helps a firm maintaining competitive advantage, even in an uncertain economy. Here, the chemical firm has no specific inventory materials management techniques that has lead to stock accumulation. The issue faced has caused profit loss, which companies cannot afford to lose if they want to stay competitive. This paper goes through the inventory management system of the chemical firm using combined FSN and XYZ analysis.

Peer-review under responsibility of the organizing committee of ICETEST – 2015

Keywords: inventory control; chemical firm; FSN analysis; XYZ analysis

*Corresponding author. Tel.: 06542268855
*E-mail address:*divyadevarajan266@gmail.com

Peer-review under responsibility of the organizing committee of ICETEST – 2015
doi:10.1016/j.protcy.2016.05.111

1. Introduction

Inventory is vital to an organization from financial and operational standpoint. Primarily, it represents a financial investment for any company, and secondly, it is essential for the provision of goods and services to the customer (Barlow, 1997). Appropriate inventory management is very important to an industry, because of involvement of significant cost regarding raw materials. It was reported (Waters, 2003) and (Bose, 2006) that a company may fail due to maintenance of unjustified surplus stocks. Therefore, optimization in inventory management is very important in an organization to regulate its financial health (Dutta, 1974), (Dutta, 1992) and (Bose, 2006).

Without proper control, inventory has a tendency to grow beyond economic limits, tie up funds and increase the cost of maintenance or the carrying cost. At the same time, the non-availability involves the cost of stock-outs, re-ordering costs and additional transit costs. Inventory control as an integrated approach is thus essential for determining the time, item(s) and quantity to indent, and amount of stock, so that purchasing and storing costs become minimum without affecting production, distribution, functional effectiveness, etc. (Dutta, 1992), (IIMM, 2006)and (Mallick et al., 2007).

In an organization, even with small size, hundreds of items may be held in a warehouse. For organizations that maintain thousands of inventory items, it is unrealistic to provide equal consideration to each item. Inventory is one of the largest and most important assets of a manufacturing business. The management of inventory and how it can provide insight into the firm's performance is a topic of interest to shareholders, investors, business owners, and the general public (De Felice, 2013). The main purpose of the inventory management practices in all production companies is to have the required items ready to be processed right on the required time with incurring minimum cost (Cakir and Canbolat, 2008).

Spare parts management needs special treatment, somewhat different from the inventory management of regular items .This is because the purpose of keeping a stock of these is different to serve as a replacement to the management of spare parts .Moreover, spare parts are not always available during the entire life-time of the equipment. Spare parts are special independent demand items deriving their demand from the failure characteristics of the component, and with a specialized supply situation. Adequate spare parts are held in stock for continuous, safe and reliable maintenance activities.

A spare part is an item of inventory used to replace failed parts. A spare part, spare, service part, repair part, or replacement part, is an interchangeable part that is kept in an inventory and used for the repair or replacement of failed units. Spare parts are an important feature of logistics management and supply chain management, often comprising dedicated spare parts management systems.

Spare parts are the lifeblood of operational reliability and plant capacity. No plant can operate at a high level of output without a reliable supply of functional spare parts. Spare parts from the bedrock on which operational reliability is built and this requires appropriate storage, treatment of, and timely access to the required parts. Yet, spare parts are also the most overlooked contributor to reliability outcomes.

Capital spares are spare parts although acknowledged to have a long life or a small chance of failure would cause shutdown of equipment for a prolonged period because of the long delivery of their replacement. Spare parts are an outgrowth of the industrial development of interchangeable parts and mass production. The basic problem of inventory control is to strike a balance between the operating efficiency and the cost of investment and other associated costs with large Inventories, with the object of keeping the basic conflicts at the minimum while optimizing the inventory holding. The decisions as to which item to make and when to keep inventories in balance require application of a wide range of techniques from simple graphical methods to more sophisticated and complex quantitative techniques. Many of these techniques employ concepts and tools of mathematics and statistics and make use of various control theories from engineering and other fields. They are primarily aimed at helping to make better decisions and getting people employed and follow a wiser policy.

The aim of this paper is to conduct FSN together with XYZ analysis to identify the items to be discarded and the amount saved. The organization of the paper is as follows: in the second section we present the case study. In the third section we discuss the research methodology explaining how the FSN and XYZ analysis is applied step by step. The fourth section we present the results and discussion. Finally, in the fifth section we come to an end with our conclusions.

2. Case study

Inventories occupy the most strategic position in the structure of working capital of most business enterprises. It constitutes the largest component of current asset in most business enterprises. In the sphere of working capital, the efficient control of inventory has passed the most serious problem. The efficiency of inventory control affects the flexibility of the firm. Proper inventory control helps to make effective use of working capital by maintaining the right amount of stocks of materials, components etc thereby over stocking is avoided. Thus, the working capital will not be blocked in excess inventory.

The stock turnover ratio of the chemical firm for the past five years is shown in the fig 1. The stock turnover ratio seems to be decreasing from the graph. Accumulation of stock is the reason behind this trend. Also the graph, turnover ratio based on the trend and the actual values shows a negative trend, clearly establishing the problem of over stocking fig 2.

Essentially the purpose of this paper is to identify the non moving items based on the value of each item of spare that helps to minimize the firm's stock accumulation by permanently disposing those items. Thus the working capital can be efficiently utilized.

3. Research methodology

The chemical firm has mainly three plants: illmenite beneficiation plant (IBP), acid regeneration plant (ARP) and pigment production plant (PPP). The first two plants IBP and ARP can be outsourced, hence our study is limited to the third plant i.e. PPP only which cannot be outsourced. The final product or pigment produced is Titanium dioxide. The PPP has three units 1) Chlorination plant, 2) Oxidation plant, 3) Surface treatment and pigment finishing plant.

In total there are 12000 spare items in the PPP. We can categorize the items as a whole to perform the inventory

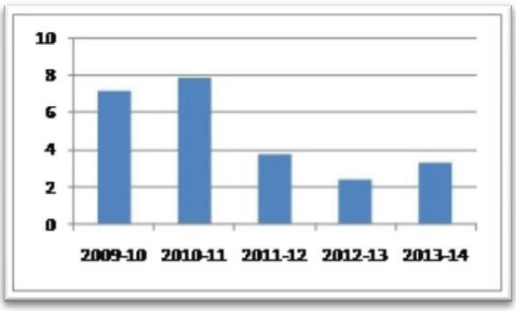

Fig 1. Stock turn over ratio

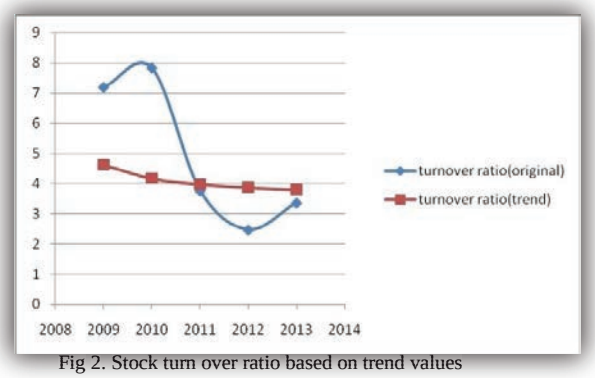

Fig 2. Stock turn over ratio based on trend values

-analysis techniques. This aim of this section is to conduct FSN together with XYZ analysis to identify the items to be discarded as scrap and the amount that could have been saved.

Inventory management is the accurate tracking of all materials in the company's inventory. The company has purchased these items from another supplier. There are three possible areas of loss that are reduced through effective inventory management: shrinkage, misplacement, and short shipments. There are various types of inventory control analysis techniques. Here we shall focus on the following:

3.1. FSN analysis (Based on Turnover ratio):

This classification is based on the consumption pattern of the materials i.e. movement analysis forms the basis. Here the items are classified into fast moving, slow moving and non-moving on the basis of frequency of transaction

FSN analysis is especially useful to combat obsolete items whether spare parts are raw materials or components. It helps in arrangement of stocks in stores and their distribution and handling methods. The main aim of this analysis is to control obsolescence of the inventories. If there is a rapid change in technology then this classification will have to be updated more often.

FSN analysis is stock turnover ratio based analysis. Stock turnover ratio is defined as the ratio of annual consumption of a material divided by its average inventory i.e.

The items can be classified into three categories viz

- Fast moving (F) those items whose stock turnover ratio is greater than 3.
- Slow moving (S) those items whose stock turnover ratio is between 1 and 3.
- Non moving (N) those items whose stock turnover ratio is below 1.

3.2. XYZ analysis (Based on stock value)

XYZ Analysis is always done for the current Stock in Inventory and aims at classifying the items into three classes on the basis of their Inventory values. The current value of the items/variants in the Inventory alone is taken into consideration for the Analysis and it is not possible to do this analysis for any other dates. Generally first 70% of the total Inventory value corresponds to X Class, the next 20% are of Y Class and the last 10% of the value corresponds to the Z Class.

3.3. Application of FSN and XYZ analysis

In any industry, not all items are required with the same frequency. Some materials are quite regularly required, yet some others are required very occasionally and some materials may have become obsolete and might not have been demanded for years together. FSN analysis groups them into three categories as Fast-moving, Slow moving and Non-moving (dead stock) respectively. Inventory policies and models for the three categories have to be different. While performing this particular analysis the turnover ratio of each item has to be calculated because the items are sorted and analyzed according to the turnover ratio it possesses.

Among the 12000 items, 1806 spares possess the maximum-minimum level. The consumption details for these 1806 items for the past 7 years are collected and the N category items are identified i.e. those items whose turnover ratio is below 1 by conducting FSN analysis using the power builder software. There are 720 items whose turnover is less than 1and are selected to conduct XYZ analysis. Steps to conduct XYZ analysis are listed below

- The current stock and the unit cost of the selected N items are collected.
- Stock value is obtained by multiplying current stock and unit cost of each item.
- Sort the stock value in descending order.
- % stock value and cumulative % stock value is calculated and tabulated.
- Finally, the class is allotted.

XYZ classification of all N category items is done and items that come under NX category are identified.

The management has to focus on the non-moving items by conducting FSN classification, to enable decision as to whether they are required in the future or they can be salvaged. Action of or disposal should be taken based on the value of each item of spare. Hence XYZ analysis is also performed along with FSN analysis. As a result of this

combined analysis, 33 items come under NX category and are chosen for discarding.

4. Results and discussion

All the Inventory Control Methods have their limitation in terms of the usage and applicability when they stand alone. FSN analysis fails when used in manufacturing environment where raw materials may be issued for production and eventually the produced items may remain in inventory giving a wrong picture of consumption. XYZ analysis is done on inventory in the stores which can vary dramatically every month for which the analysis is done. Various external factors like lost or delayed sales orders and supplies can influence the analysis.

Hence it becomes necessary to combine more than one classification scheme and make use of them to further sub-categorize the inventory and devise appropriate inventory control system for each of them. In practice, organizations have utilized a variety of these combinations to implement appropriate inventory control system for the items.

Here, attention of the management should focus on the non-moving items to enable decision as to whether they are required in the future or they can be salvaged. All non-moving items (N) identified using FSN analysis cannot be disposed of. The disposal should be taken based on the value of each item of spare by conducting XYZ analysis on the N category items. Table 1 shows items that come under NX category.

Table 1. NX category items

Sl no:	Item code	Current stock	Currency	Unit cost	Stock value (Rs.)	% stock value	Cum.% stock value	Class
681	679406721	5	EURO	14850.00	5221921	16.1079803	16.1079803	NX
591	679405001	1	INR	3323033.0	3323033	10.2505097	26.3584900	NX
82	671207000	2	USD	15281.00	1956894	6.03640146	32.3948915	NX
458	672447600	1	EURO	16546.45	1163694	3.58962816	35.9845197	NX
506	673403120	2	INR	458150.00	916300	2.82649677	38.8110164	NX
76	671205280	2	USD	5610.00	718420	2.21609922	41.0271157	NX
572	675462000	4	INR	174050.00	696200	2.14755763	43.1746733	NX
408	672446620	10	USD	1024.00	655670	2.02253619	45.1972095	NX
465	672447682	2	EURO	3788.55	532889	1.64379498	46.8410045	NX
544	675320200	2	USD	3877.78	496591	1.53182624	48.3728307	NX
553	675417000	1	INR	487860.00	487860	1.50489437	49.8777251	NX
66	671201600	2	USD	3721.00	476513	1.46989397	51.3476191	NX
395	672446047	88	USD	78.00	439504	1.35573129	52.7033504	NX
250	671381720	1	INR	410400.00	410400	1.26595468	53.9693050	NX
473	672447747	42	EURO	132.37	390996	1.20610048	55.1754055	NX
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

XYZ analysis is based on the value of closing stocks of inventory (including investment in inventories). The result of the XYZ analysis provide information that helps evaluate how each inventory part should be monitored and controlled. These controls are typically:

- X class items which are critically important and require close monitoring and tight control.
- Y class items are of lower criticality requiring standard controls and periodic reviews of usage.
- Z class require the least controls, are sometimes issues as “free stock” or forward holding.

A closing stock theory applied to a combination of XYZ with FSN indicates: If a non-moving (N) item is found in X category i.e. NX category, the decision is to dispose of the N items by selling them off [7].

There are 625 items under NZ (non-moving item found in Z category), 62 items under NY (non-moving item found in Y category) and 33 items under NX (non-moving item found in Z category) that are to be discarded. Total Stock value of all NX items is Rs. 22575608. By salvaging these items space as well as money can be saved.

5. Conclusion

All the Inventory Control Methods have their limitation in terms of the usage and applicability when they stand alone. Hence it becomes necessary to combine more than one classification scheme and make use of them to further sub-categorize the inventory and devise appropriate inventory control system for each of them. Here, combined FSN and XYZ helped in identifying the spares to be salvaged. This two dimensional classification results in the identification of NX category items and are decided to dispose of the N items by selling them off.

It is expected that the company by effective implementation of the model and the relative results would bring about a gradual reduction in excess pile up of inventory. Further, the procedure if continued could bring about savings through effective spare management.

Acknowledgements

The authors are thankful to R Sreekumar, plant engineer in the chemical firm and his staff; and also to Dr. Sasikumar, Dr. Biju Augustine, Dr. G Venugopal, Dr. Ciby Thomas, Prof. Reghunathan Rajesh, Dean, Faculty of Mechanical Engineering, Rajiv Gandhi Institute of Technology, kottayam, kerala, for providing the necessary facilities for the preparation of the paper.

References

[1] Shibamay Mitra, M Sukumar Reddy, Kumar Prince, “Inventory Control Using FSN Analysis – A Case Study on a Manufacturing Industry.” IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 4, April 2015.

[2] Numera Tahir, Muhammad Abbas Choudhary, “Development of a Decision Support System for Inventory Analysis and Control.” IEEE Int'l Technology Management Conference, 2011.

[3] Ye Chen, Kevin W. Li, Si-feng Liu, “A Comparative Study on Multicriteria ABC Analysis in Inventory Management.”, 2008 IEEE International Conference on Systems, Man and Cybernetics (SMC2008).

[4] Li Hongwei, Xiong Yun, Su Dazhen, Zhao Yang, “An Inventory Control Model for Materials Based on Time Effectiveness.”, 3rd International Conference on Information Management, Innovation Management and Industrial Engineering, 2010.

[5] Stratos Ioannidis, Vassilis S. Kouikoglou, " Analysis of Admission and Inventory Control Policies for Production Network.”, IEEE Transactions on Automation Science and Engineering, vol. 5, no. 2, april 2008.

[6] M. Bevilacqua, F.E. Ciarapica, G. Giacchetta, “Spare parts inventory control for the maintenance of productive plants.”, Proceedings of the 2008 IEEE IEEM, 2008.

[7] A. K. Chitale, Chitale A. K., R. C. Gupta, gupta R. C (2011),”Materials Management _ Text and Cases” published by PHI learning private limited.